progress of construction

SOUTH SASKATCHEWAN RIVER DAM

THE PURPOSE

1. Stabilize agriculture in the region through irrigation and provision of more dependable water supplies.
2. Provide hydro-electric power.
3. Provide a more abundant supply of good water for domestic and industrial purposes.
4. Reduce flood hazards on the river through better river regulation.
5. Create greater facilities for recreation.

HISTORY

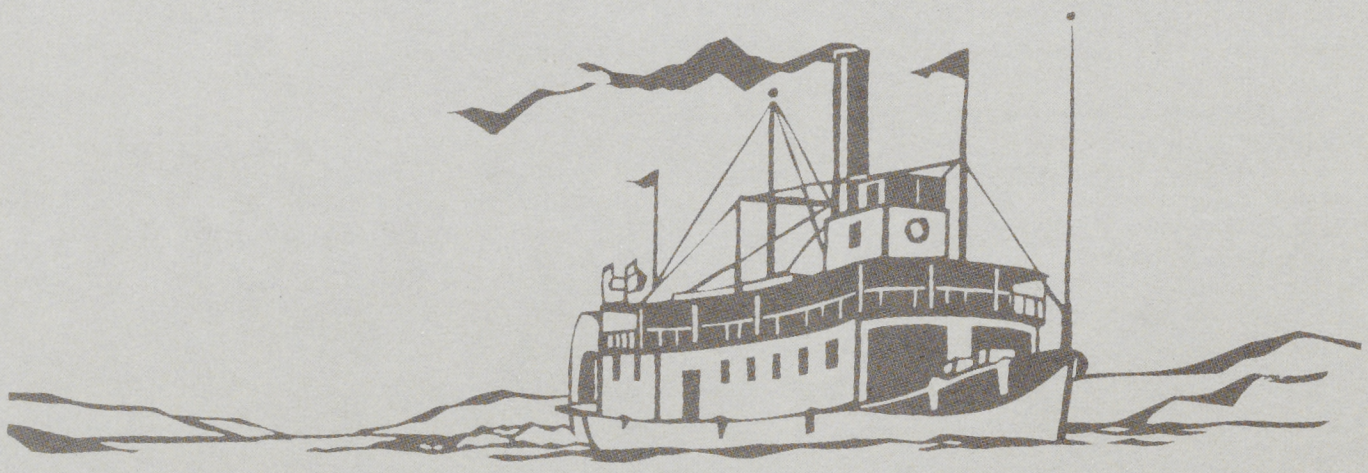
July 25, 1958!
This is an important date because it brought the dream of damming the South Saskatchewan River—a dream that has persisted for 100 years—into the world of reality. On this date, an agreement was signed by the Government of Canada, previously ratified by the Government of Saskatchewan, authorizing construction of the South Saskatchewan River Project.

AN EARLY VIEW

In 1857 the British Government sent an expedition under Captain Palliser to explore Western Canada. The next year the Government of Canada sent an expedition under Professor H. Y. Hind of Trinity College to explore the Assiniboine and Saskatchewan River Valleys. Both explorers noted the close interrelationship between the valley of the South Saskatchewan and the Qu'Appelle lake and river system. Palliser suggested the feasibility of a navigable route connecting the two valleys; Hind thought a dam should be built across the South Saskatchewan to direct its waters down the Qu'Appelle Valley. But, with the Canadian Pacific completing its trans-continental railway in 1885, the concept of a water route to the west faded.

URBAN AREA EXPANSION

Sixty years ago when Regina and Moose Jaw were fast-growing centers, along with several smaller communities, serious water shortages were experienced. Again the idea of a dam across the South Saskatchewan became the talk of the early 1900's. Subsequent representations to Government for the construction of a dam to direct some water from the South Saskatchewan River into Buffalo Pound Lake and augment their meagre supply were heard, but the proposed project was considered too costly. This situation continued until 1954 when PFRA was authorized to construct works for pumping water from the South Saskatchewan River over a divide into the Qu'Appelle Valley to feed Buffalo Pound Lake used as a source of water supply for the two cities.



DROUGHT

In 1935 the Government of Canada established the Prairie Farm Rehabilitation Administration, now popularly known as PFRA, to find ways and means of overcoming drought on the prairies and to alleviate the depressed conditions which resulted.

In 1939, PFRA had carried out extensive studies and surveys to determine the soundness of using existing water resources to meet these needs. In that year they launched a study of the William Pearce proposal [1]/ with surveys more particularly directed toward the possibility of irrigating some specific areas in Alberta with a possible extension into western Saskatchewan. In the findings of this survey, some of the soils were unsuitable for irrigation, and the proposed extension into Saskatchewan presented some major physical difficulties. Certain modified versions of this proposal, however, are still under consideration.

In 1943, PFRA began a study to determine the feasibility of diverting the South Saskatchewan River well inside the Saskatchewan boundary, and creating a storage reservoir near the area of need. This would eliminate building lengthy and costly artificial waterways and, at the same time, would make water available for other existing needs. Ten different sites along 100 miles of the South Saskatchewan River were investigated before the present site was chosen as being the most suitable.

In 1947, PFRA filed a report indicating a choice of site, the feasibility of construction, an estimate of the cost, and descriptions of the benefits which could be derived from the project.

TIME FOR ACTION

Early in 1958 the Government of Canada entered into negotiations with the Province of Saskatchewan to proceed with the project as outlined in the PFRA report and an agreement was signed before the end of that year. The cost of construction is to be shared by the two governments with Canada paying 75 per cent and Saskatchewan 25 per cent, with the Province's share limited to $25,000,000. Upon completion, Canada is to maintain the works for a period of 10 years, and be responsible for the cost of such maintenance for a period of six years. During the remaining four years, the cost is to be shared equally.

The agreement also stipulates that when Saskatchewan proceeds with the construction of hydro-electric power facilities, the cost of these is to be borne by Saskatchewan except that Canada shall contribute 25 per cent of the cost of constructing and installing such penstocks as may be necessary to produce 200,000 h.p. at minimum operating head. Saskatchewan also agrees to assume full responsibility for, and undertake the construction, operation and maintenance of all the irrigation works required for the conveyance and distribution of water to all lands to be irrigated by the reservoir.

[1]/By 1919, engineer-land surveyor Pearce made study of diverting water for irrigation from the North Saskatchewan, Clearwater and Red Deer rivers. Department of Interior survey in 1920 confirmed Pearce proposal that a tract of land in the Youngstown-Hanna district in Alberta and another in Rosetown-Outlook-Saskatoon area in Saskatchewan be irrigated. Survey established the physical practicability but the project was not considered to be economically feasible at that time.

SOUTH SASKATCHEWAN RIVER PROJECT

THE DAM

The dam, which is located midway between the towns of Outlook and Elbow, will be the largest rolled-earth fill of its kind in Canada. In fact, it will rank as one of the largest of its type in the world, rising 210 feet above the present river-bed and stretching about 3 miles across the valley.

The diversion works for the dam will contain the flow of the river while the main embankment is under construction. These consist of 5 concrete tunnels, each 4,300 feet long and 20 feet in diameter, built in bedrock through the west bank of the dam. Eventually, the tunnels will serve a power station, to be built at the site, and regulate the downstream flow from the reservoir.

The spillway, to be located on the west bank of the river, will be of reinforced concrete, gated, and will utilize a natural depression in the area. The spillway will be 17,000 feet long, including an 8,000-foot approach, a 3,000-foot concrete control structure, and a 6,000-foot exit channel.

A second dam, about 12 miles southeast of the town of Elbow, will control the flow of water from the South Saskatchewan River Reservoir into the Qu'Appelle Valley. This dam will be 90 feet high, 10,200 feet long and 1,900 feet wide at its base. Water in the reservoir at this point will be 70 feet deep at full supply level.

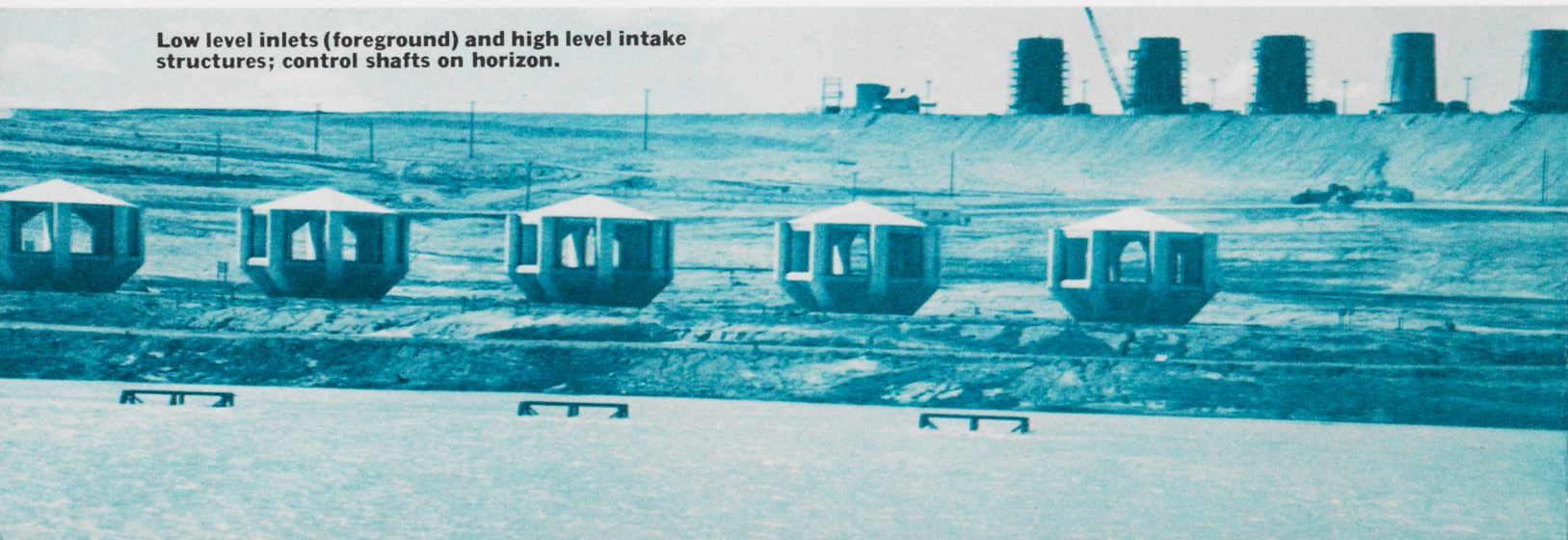
THE RIVER

The South Saskatchewan River begins in the Rocky Mountains, flows east to Elbow and then swings sharply northward through Saskatoon to join the North Saskatchewan some 30 miles east of Prince Albert. From here, it flows east to Lake Winnipeg and eventually empties into Hudson Bay.

In the plains region, the South Saskatchewan River flows through a deeply entrenched valley with a relatively flat gradient. The depth of the valley has been the main deterrent to development in the past because of the high cost of dam construction. On the other hand, the deep valley and flat gradient provide a large storage area which has made multiple-use development possible.

THE RESERVOIR

The main reservoir of the South Saskatchewan River Project will impound 8,000,000 acre-feet of water. It will be 140 miles long, 192 feet deep at the dam, and will have a shoreline of 475 miles, making it the largest lake in the Canadian central plains. About 109,600 acres of land will be flooded to create the reservoir. Of this, 5.2 per cent is presently under cultivation. The remaining land is immediately adjacent to the river and is mainly used for grazing.



Low level inlets (foreground) and high level intake structures; control shafts on horizon.

PROGRESS OF CONSTRUCTION

With construction now entering its seventh year on the South Saskatchewan River Project, the shape and dimension of the project to be is gradually emerging as work forces press forward on the final stages of its construction. Scheduled for completion in 1966, emphasis in construction has been focused mainly on the building of the dam on the South Saskatchewan River located midway between the towns of Elbow and Outlook. More recently construction was started on the second dam in the Qu'Appelle Valley. To carry out this work, a total of 44 contracts have been awarded, valued at over $96.6 million, of which $71 million have been expended.

Construction activity at the South Saskatchewan River Dam began in the late fall of 1958. The initial requirement was roads to provide access into the area. Headquarters facilities at the site to accommodate P.F.R.A. engineering and administrative personnel supervising construction of the project were also necessary. This work was carried out during the first winter.

In November (1958), a contract for processing and stock piling aggregate required in concrete and pervious filter areas, got under way. In mid-December, work was started on the piers for a construction bridge to provide a means by which men and equipment might cross the river.

Work on the embankment began the following spring. Because of the magnitude of the structure, and the nature of the valley, the embankment has been developed in several stages. This has involved raising the embankment to progressively higher elevations on either side of the river, while steadily narrowing the channel between the two abutments in preparation for the time when the river could be closed off entirely, and the water redirected via five diversion tunnels.

The job of building the tunnels took approximately 4 years (1960-64). Mechanical mining equipment, commonly referred to as a "Mole," was used in the tunneling operation. The tunnels were mined to a diameter of 25 feet, and the walls shored with steel ring beams. These beams were placed at 30-inch intervals throughout the more than four miles of tunnels. A concrete lining 2½ feet thick was applied the entire length of the tunnels, bringing their inside diameter when completed, to 20 feet. The three tunnels to be used for hydro-electric power production have been reinforced with steel liners from the centerline of the dam to the downstream end of the tunnels.

The multi-purpose function of the tunnels has necessitated the installation of intakes at two elevations. The low-level intakes were temporarily required to divert the river's flow during final stages of construction. The permanent intakes appear as mushroom-shaped structures placed higher on the embankment, and will eventually carry the flow. They will also prevent tunnel silting problems and will assure clean water, free of erosive material, for the power turbines.

Each tunnel is equipped with control gates to regulate tunnel flows. These gates are situated in that area where the tunnels pass under the highest point of the dam. Shafts have been excavated from the top of the dam, and extend down 220 feet to intersect the tunnels. On top of the shafts, 5 cone-shaped concrete structures have been built to house the electrically operated hoists which raise and lower the gates as required. The essential work to make the tunnels and gates operative was completed early in 1964, and the actual diversion operation took place on February 14 when the river began to flow through the tunnels.

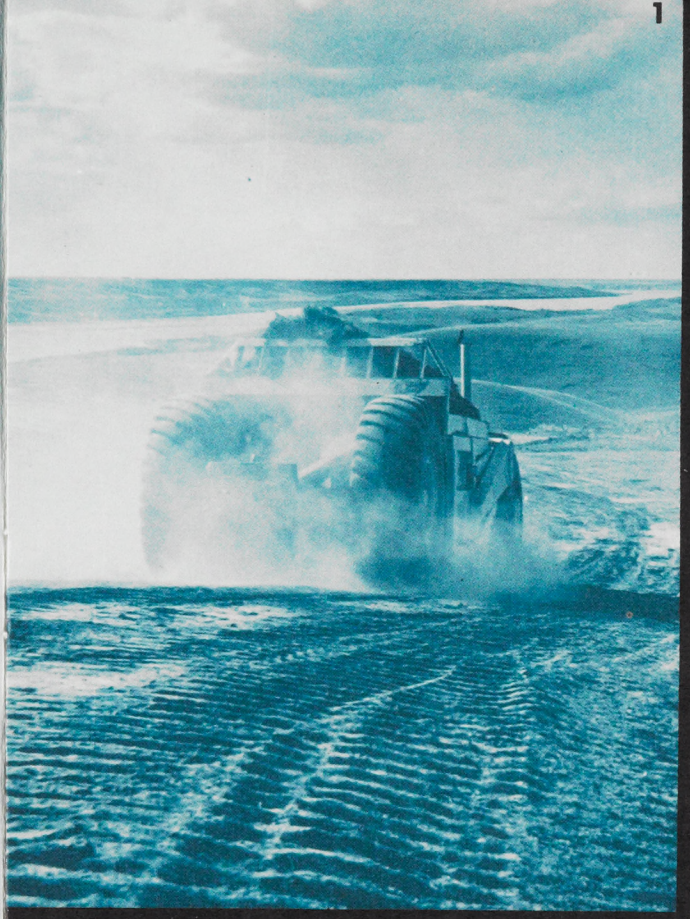
Following closure of the river, a degree of ponding developed upstream of the main dam. In anticipation of this, and of later flooding, pumping installations operated by P.F.R.A. to deliver water into the Qu'Appelle River system were dismantled, together with a railway bridge crossing the river at Elbow. Sections of highway, power lines and other public utilities, which would eventually be inundated by rising waters, have been relocated.

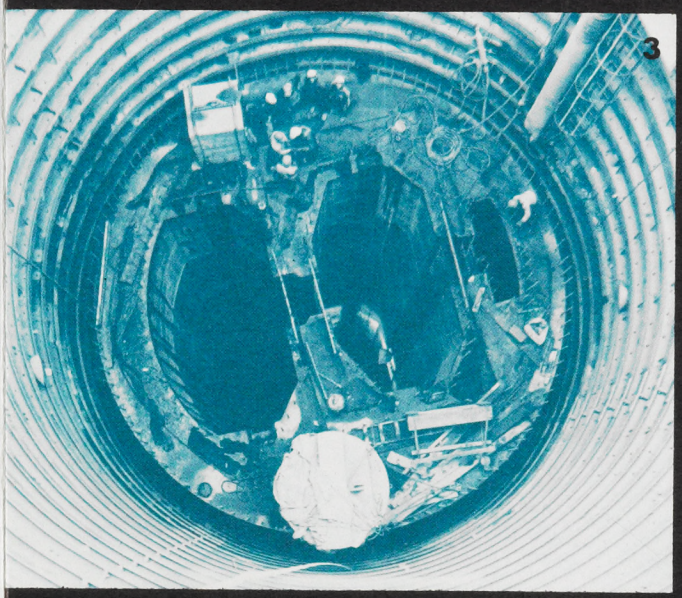
Included among the phases of work remaining is completion of the last stage of earth construction involving the center section of the dam across the original river

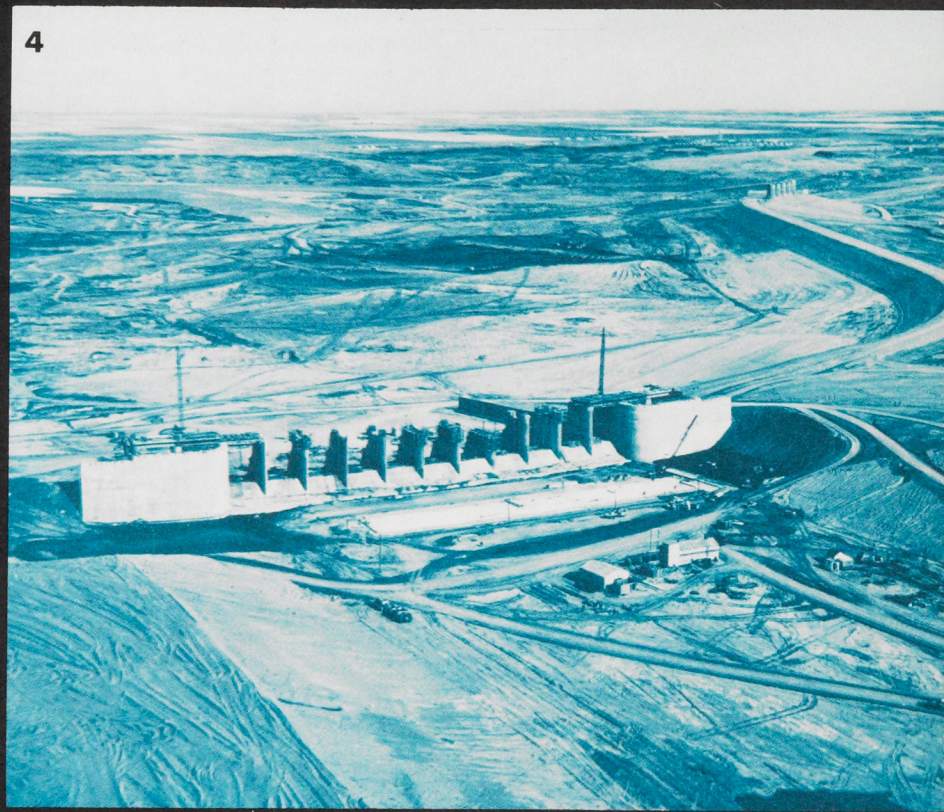
channel, and raising the over-all embankment to its final height of 210 feet. The contract for this was awarded early in 1964 with work started that summer.

On the spillway, construction has been confined to excavation and pouring of concrete for the crest section of the structure. At the crest, massive concrete piers rise to the same elevation as the top of the dam, and support a traffic bridge over the spillway. Radial gates for regulating flow down the spillway are housed between the pillars. There are 11 such gates, each 40 feet wide and 30 feet high. A further contract is involved in construction of the reinforced concrete spillway chute and stilling basin. Much of the excavation for this phase of development has been done under a previous embankment contract.

A major portion of work on the Qu'Appelle Dam lies ahead. This structure was started late in the fall of '63 when construction was confined to a minor amount of earth and concrete work on the conduit section before winter set in. The conduit was completed during 1964 along with a considerable amount of earthwork. Now preparations are being made for adding a chute and stilling basin at the outlet end of the conduit.







1 Scraper at work.

2 Control shaft superstructures.

3 Gate wells—control shaft substructures.

4 Spillway crest.

5 Construction bridge.

ENGINEERING SERVICES

Years of investigations and intensive engineering studies have gone into building the South Saskatchewan River Project. In the planning and design a large amount of basic information was required. In this respect, PFRA has been fortunate in having trained personnel with many years of experience in the development of large structures such as the St. Mary, Waterton and Travers Dams in Alberta. In addition, wide experience has been gained in the construction of hundreds of smaller water conservation projects built by PFRA across the four western provinces.

Leadership on the South Saskatchewan River Project was originally provided by the late Gordon L. MacKenzie, Director of PFRA during the formative stages of the project's construction, and in the years previous when the project was still under investigation. At that time, Mr. MacKenzie held the position of Chief Engineer.

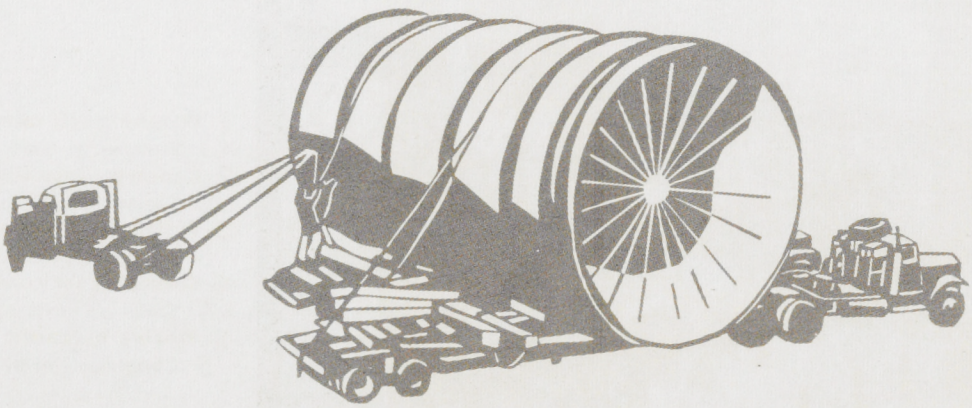
The officer presently responsible for all engineering services is J. Gordon Watson, Chief Engineer of PFRA. Assistant Chief Engineer is Walter B. Thomson who also serves as Project Engineer. He is responsible for all aspects of engineering administration and supervision of construction associated with the South Saskatchewan River Project. Senior officer in charge of construction at the damsite is A. S. Ringheim. The main sections of organization from an engineering standpoint are Surveys Division, Hydrology Division, Air Photo Analysis and Engineering Geology Division, and the Design Division.

The major planning and design work associated with construction on the project is carried out by these divisions. The offices are located at PFRA headquarters in Regina. Office and laboratory facilities for the Soil Mechanics and Materials Division are located in Saskatoon.

CONSTRUCTION HEADQUARTERS

PFRA personnel at the damsite carry out all the engineering tasks associated with the construction of the project in accordance with the specifications laid down by the technical divisions. Since this requires steady and continuous inspection and supervision while the work is in progress, these people must be headquartered at the construction site. At the headquarters all necessary administrative and engineering offices required to carry out these duties are provided, together with a laboratory for the testing of soil and concrete used in construction, a garage and warehouse, a staff house for single workers and residential accommodation for married personnel. In addition, an assembly hall is provided where religious services and social functions are held, as well as technical and staff meetings.

To accommodate visitors who come to the site each year to view construction, a tourist pavilion has been built on a vantage point overlooking the construction area and is manned by qualified attendants. Since construction began in 1958, from 65,000 to 85,000 people have visited the pavilion annually.



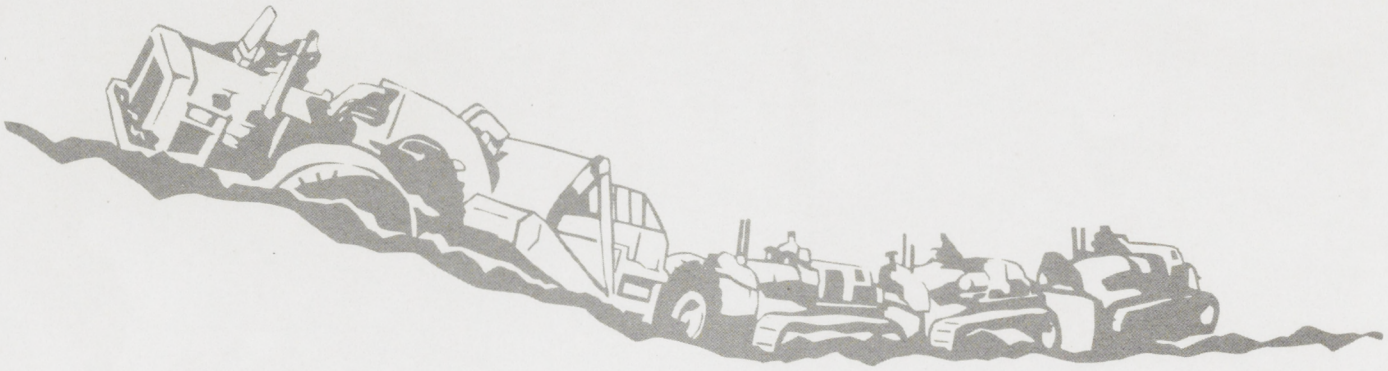
1 Weighing soil samples.

2 Concrete-lined diversion tunnel.

3 Testing concrete specimens.

4 Surveying for construction.

5 Testing hydraulic model of spillway.



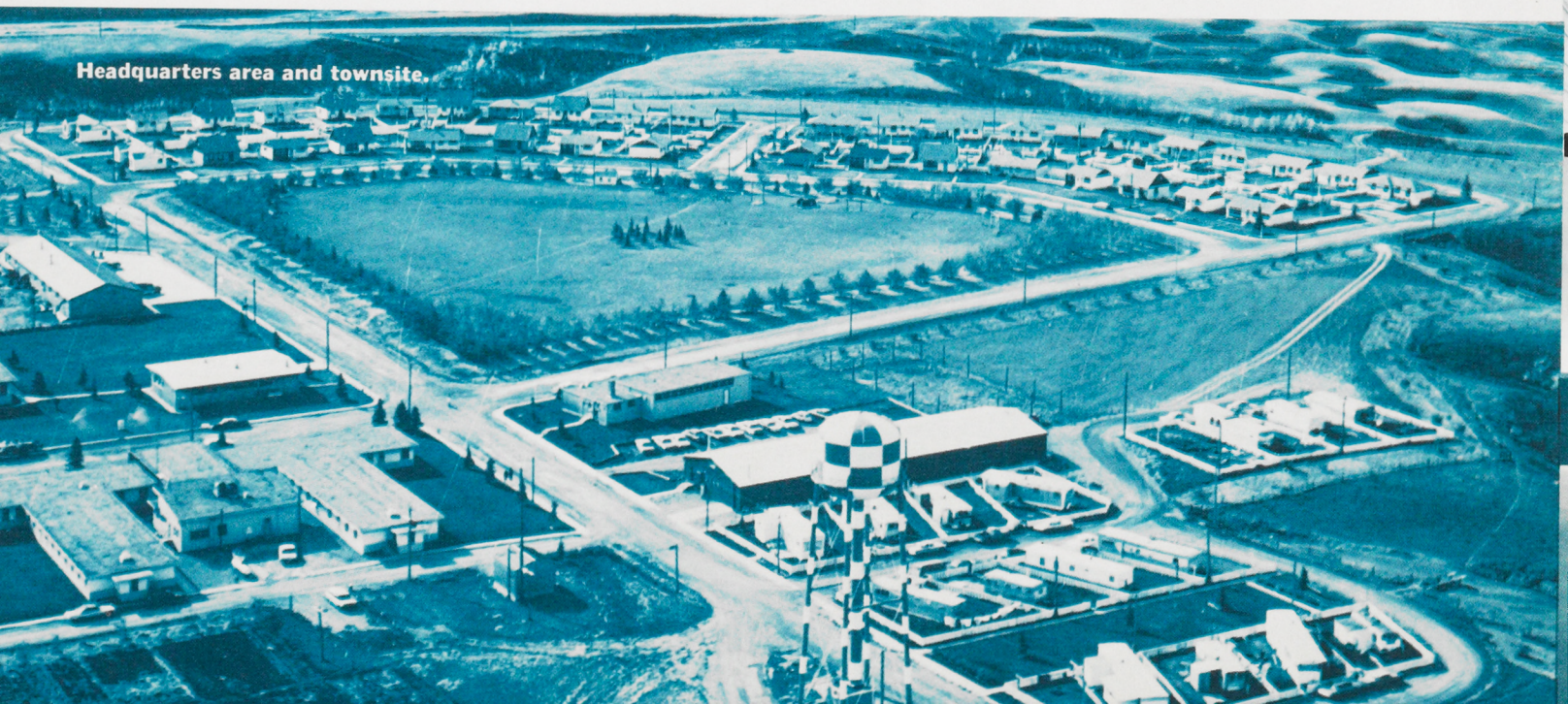
LIFE AT THE DAMSITE

Married personnel stationed at the site live in houses rented from PFRA, or in their own trailers within a trailer court maintained by the Administration in the headquarters area. Arrangements have been made with the Outlook School Board which permit the children to attend school in Outlook. They are transported the 24 miles to and from Outlook by a PFRA bus, with the cost being borne by the parents concerned.

The organization owns a modern fire truck and equipment which is manned by a volunteer fire brigade of PFRA employees. A room in the staff house has been equipped as a first-aid treatment room. PFRA also maintains a fully equipped ambulance and has several trained first-aid men on the staff.

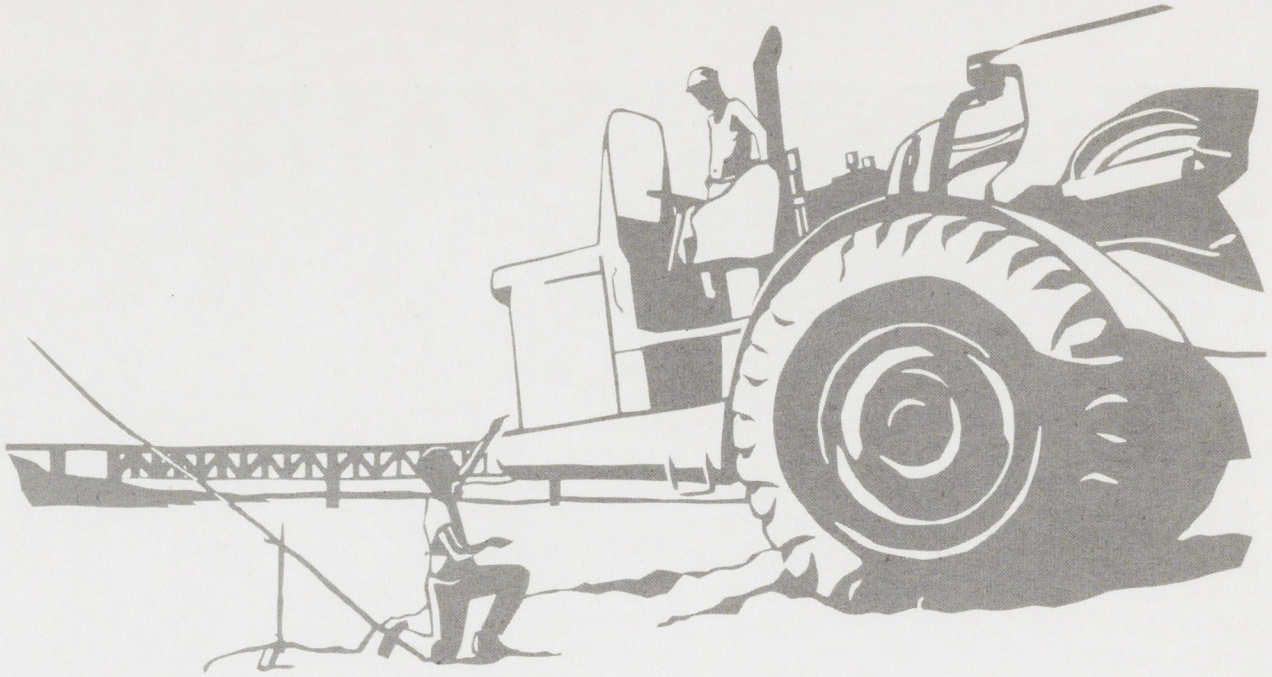
Families with the private contracting firms live either in trailers located in a commercial trailer court near the construction area, or in homes in nearby towns or in trailers kept in farmers' yards. In certain cases, the contractors also maintain staff quarters for single men on serviced lots provided by PFRA. During peak construction periods, there have been approximately 1,200 workmen employed on the project with a total payroll of around $500,000 per month.

Since construction started, several commercial enterprises have been established adjacent to the headquarters area. Building in this location is controlled by local municipal bylaws and has been given the official postal designation of Cutbank. In this area there are 3 general stores, a post office, 2 eating establishments, 2 service stations and a bank subsidiary.



Headquarters area and townsite.


MAP OF DAM AND AREA
PROPOSED RESERVOIR
PROPOSED IRRIGATED AREA
KEY MAP
DAM
SASKATOON
MOOSE JAW
REGINA
SASKATOON
DELISLE
7
42
OUTLOOK
15
SOUTH SASK. DAM
11
ELBOW
QU'APPELLE RIVER DAM
N
FLOW
19
1
REGINA
MOOSE JAW
1
SWIFT CURRENT



Familiar scenes at the South Saskatchewan River Dam Project.

PROJECT STATISTICS

SOUTH SASK. RIVER DAM

Height	210 feet
Length—overall	16,700 feet
Width at base	5,300 feet
Vol. of embankment	73,000,000 cu. yds.
Vol. of excavation	105,000,000 cu. yds.
Vol. of concrete	620,000 cu. yds.
Vol. of rip-rap	400,000 cu. yds.

SPILLWAY

Type—Gate controlled concrete chute

Length of chute	3,830 feet
Length of crest	528 feet
Discharge capacity	265,000 c.f.s.

DIVERSION WORKS

Type	Tunnels
No. of tunnels	5
Average length	4,300 feet
Size of tunnels	20 ft. dia.

RESERVOIR

Area	109,600 acres
Total storage	8,000,000 ac. ft.
Usable storage	2,750,000 ac. ft.
Length of shoreline	475 miles
Length of reservoir	140 miles
Depth of water at dam	192 feet

QU'APPELLE RIVER DAM

Height	90 feet
Length	10,200 feet
Width at base	1,900 feet
Vol. of embankment	14,000,000 cu. yds.
Vol. of rip-rap	350,000 cu. yds.

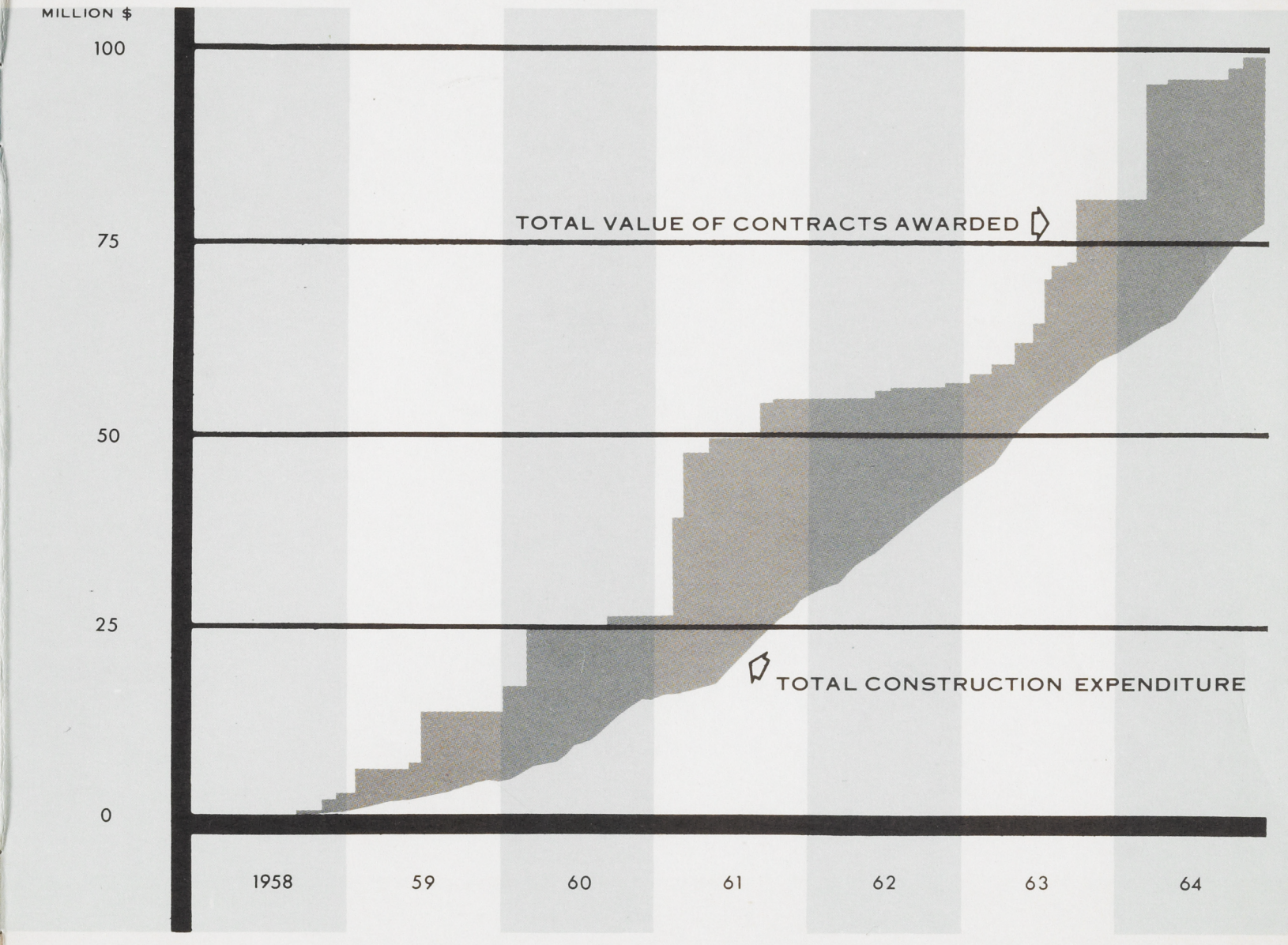
DRAINAGE BASIN

Total for river	65,500 sq. mi.
Above damsite	48,800 sq. mi.

PROGRESS BY CONTRACT

CONTRACT	WORK INVOLVED	CONTRACTOR	AMOUNT
No. 1	*East Access road	Evans Construction Co. Ltd.	$ 164,330.63
No. 2	*Aggregate processing	McNamara Limited	878,681.12
No. 3	*Headquarters arteries construction	Beattie Ramsay Const. Co. Ltd.	242,236.56
No. 4	*Headquarters buildings	Smith Bros. & Wilson Ltd.	743,933.73
No. 5	*Bridge substructure	The Foundation Co. of Canada Ltd.	314,949.42
No. 6	*East embankment (Stage 1)	Perini Ltd.	2,990,919.61
No. 7	*North access road	Taylor Bros.	143,479.49
No. 8	*Bridge superstructure	Bird Construction Co. Ltd.	1,044,168.38
No. 9	*West embankment (Stage 2)	Piggott Construction Ltd.	8,350,285.65
No. 10	*Headquarters water supply system	Beattie Ramsay Const. Co. Ltd.	23,392.00
No. 11	*Headquarters pumping units	Canadian Fairbanks Morse Co. Ltd.	12,026.00
No. 12	*Tourist pavilion	Bird Construction Co. Ltd.	20,771.00
No. 13	*Coteau Creek Embankment (Stage 3)	Bedford Construction Co. Ltd.	8,297,950.00
No. 14	*Downstream diversion tunnels	Kiewit-Johnson-Poole	8,344,175.00
No. 15	*Steel ring beams	Commercial Shearing Ltd.	2,637,250.00
No. 16	*Revision highway No. 45	Pederson Construction Ltd.	118,664.91
No. 17	*Revision highway No. 19	Acorn Construction Ltd.	249,178.57
No. 18	*Cement (downstream portals)	Canada Cement Co. Ltd.	117,008.48
No. 19	*Relief wells and conduit	Piggott Construction Ltd.	242,911.04
No. 20	*Gravel revision highway No. 45	W. F. Bodkin Construction Ltd.	14,208.84
No. 21	*Upstream diversion tunnels	Kiewit-Johnson-Poole	8,658,500.00
No. 22	*Aggregate processing	McNamara Limited	1,656,536.75
No. 23	*Gravel revision highway No. 19	Nick Linden Construction	35,405.35
No. 24	*Cement (diversion tunnels)	Inland Cement Co. Ltd. Canada Cement Co. Ltd.	1,866,672.12 1,251,171.86
No. 25	*Tunnel control shaft substructures	Kiewit-Johnson-Poole	5,005,520.00
No. 26	*Revision highway (Tichfield to No. 15)	Sanderson & Elgert	128,649.53
No. 27	*Tunnel outlet basins	Bedford Construction Co. Ltd.	1,128,425.00
No. 28	Control shaft superstructures	Kiewit-Johnson-Poole	955,048.00
No. 29	*Tunnel control gates and embedded parts	Dominion Bridge Co. Ltd.	1,236,860.89
No. 30	*Supply tunnel ring beams	Sask. Steel Fabricators Ltd.	515,885.55
No. 31	Embankment (Stage 4)	McNamara Construction Western Ltd.	4,153,500.00
No. 32	*Tunnel control gate hoists	Dominion Bridge Co. Ltd.	370,654.00
No. 33	*Gravelling highway revision (Tichfield to No. 15)	South Construction Co. Ltd.	14,748.67
No. 34	Spillway crest	Kiewit-Johnson-Poole	5,363,652.21
No. 35	Cement for diversion works	Canada Cement Co. Ltd.	911,339.25
No. 35A	Cement for diversion works	Inland Cement Co. Ltd.	911,339.25
No. 36	Qu'Appelle River Dam	E. Anderson, Square M, Coleman Colleries	9,593,230.00
No. 37	**Spillway chute and basin	—	—
No. 38	Embankment (Stage 5)	McNamara Const. Western Ltd.	15,598,860.00
No. 39	*Cathodic protection (Stage 1)	Cathodic Protection Service Ltd.	85,749.90
No. 40	Spillway gates and hoists	—	—
No. 41	Supply flyash	Saskatchewan Power Corporation	204,315.00
No. 42A	Reservoir clearing (Stage 1)	—	—
No. 43	Low level bulkheads for tunnels	Falcon Engineering Co. Ltd.	65,906.18
No. 44	Control gates and hoists Qu'Appelle River Dam	Canadian Car (Pacific) Ltd.	130,600.00
No. 45	Embankment (Stage 3A)	Standard-General Construction (International) Ltd.	989,999.00
No. 46	**Qu'Appelle River Dam—miscellaneous work	—	—
No. 47	Plugging of tunnels	Kiewit-Johnson-Poole	398,000.00
No. 48	Cathodic protection (Stage 2)	Cathodic Protection Service Ltd.	166,000.00

*—Denotes contracts completed.
**—Denotes contracts to be tendered.
All other contracts in operation.


MILLION $
100
75
50
25
0
TOTAL VALUE OF CONTRACTS AWARDED
TOTAL CONSTRUCTION EXPENDITURE
1958
59
60
61
62
63
64

SOUTH SASKATCHEWAN RIVER DAM

Prepared by Information Division,
Canada Department of Agriculture.

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